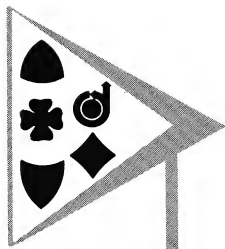
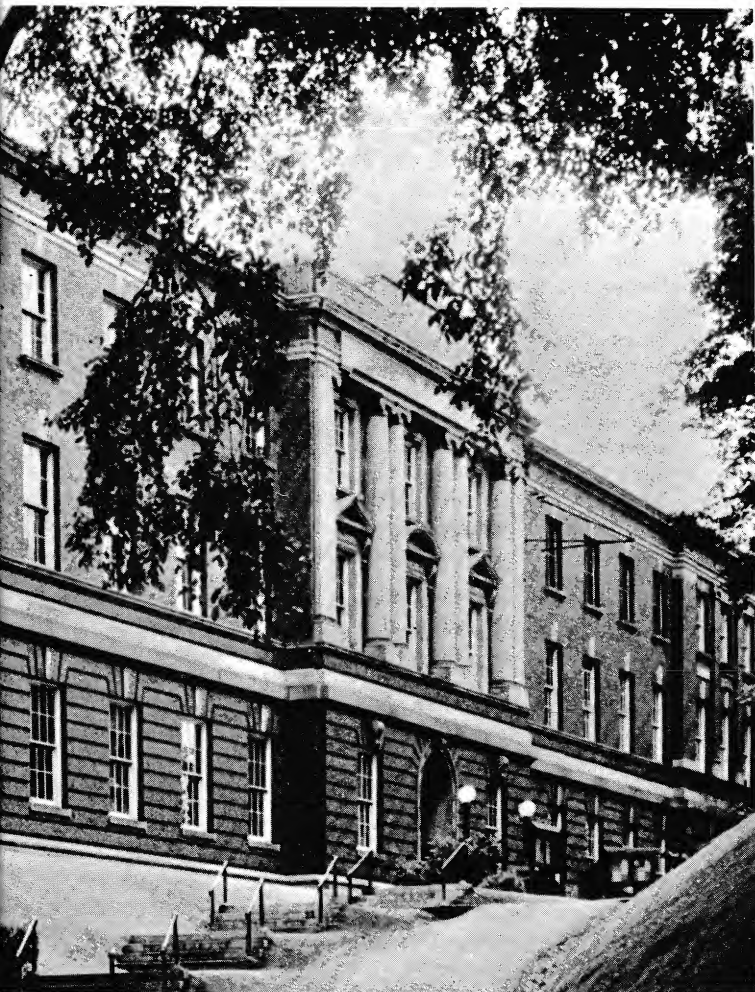


1965 JOINT AUTOMATIC CONTROL CONFERENCE



RENSSELAER POLYTECHNIC INSTITUTE
TROY, NEW YORK



**TUES. - WED. - THURS. - FRI.
JUNE 22-23-24-25
1965**

Welcome

TO THE

1965

JOINT AUTOMATIC CONTROL CONFERENCE

June 22, 23, 24, 25, 1965
Rensselaer Polytechnic Institute
Troy, New York

The 1965 JACC, sixth of the series, is the single annual forum for presenting the latest developments in control theory, applications, components, and control systems. Since 1960 the sponsoring societies have held a single conference in lieu of many individual conferences to describe the yearly progress. The growth of the conference demonstrates how well the Joint Conference has been accepted. Under the sponsorship of the American Automatic Control Council the five professional societies: AIAA, AICHE, ASME, IEEE and ISA are encouraging contributions to the technical literature of automatic control. The sponsor society this year is the Automatic Control Division of the American Society of Mechanical Engineers.

Details of the technical meetings are described in the program. These are presented at 28 sessions during four days; six of these sessions constitute invited papers describing the state of the art in applications and components, always of great interest to control engineers. Growth of the conference now requires an extra afternoon to accommodate two tutorial sessions and two panel sessions.

The sociological and technological import of automatic control will be discussed by two eminent men of our times. On Wednesday evening Mr. Leonard Woodcock, of the United Automobile Workers of America, and Dr. J. Herbert Holloman, Assistant Secretary of Commerce for Science and Technology, U. S. Department of Commerce, will present their respective viewpoints of this subject that affects control engineers so deeply.

The present social practices of past conferences are continued. A conference reception will be held Tuesday evening when the afternoon technical meetings are over. It will provide a time to renew old acquaintances and make new ones. Our annual banquet will take place as is the

custom on Thursday evening. Entertainment will be included following a delightful innovation of the last two years.

SIDNEY LEES	
Conference Chairman	
J. M. MOORE	C. N. SHEN
Program Chairman	Local Arrangements Chairman

SOCIAL FUNCTIONS

Conference Reception

Time: Tuesday, June 22, 7-9:30 p.m.

Place: Rensselaer Society of Engineers

Our mixer is to be held at the fraternity house of one of the oldest social organizations of engineering students. Renew old acquaintanceships, make new friends in this area of common interest, it is all included in the conference fee.

Conference Banquet

Time: Thursday, June 24, 6:30-10 p.m.

Place: Thruway Motel Inn, Washington Ave., Albany; near Thruway

Event: Cocktails, Dinner, Musical Program

As a special attraction there will be a program of traditional music by the Beers' Family. These artists are well-known from their performances on television, in concert halls, at folk music festivals, and by their recordings for Columbia Masterworks. Their skill has been rewarded with the TV Radio Mirror Gold Medal Award and by the Burl Ives Annual Award for traditional music. Their repertoire consists of songs that have been in the family

Acknowledgments

The Conference is indebted to the following patrons who have contributed to the success of the program.

*International Business Machines Corp.
Advanced Systems Development Division
White Plains, N. Y.*

*The General Electric Company
Schenectady, N. Y.
Advanced Technology Laboratories
Engineering Services
Electric Utilities Sales Organization
Industrial Sales Organization
Gas Turbine Department
Large Turbine and Generator Department*

for many years. They provide their own accompaniment with such instruments as the psaltery and supplement the performance with old fashioned dancing dolls.

The banquet will start 6:30 with a Dutch Treat Cocktail party followed by a full course dinner and then by the Beers' Family musical program.

Charter busses will provide, gratis, round trip transportation to the banquet from the RPI Campus. Bus schedules will be available at the registration area. Tickets at \$6.75 per person will be required for the banquet. These may be ordered on the registration form or purchased at the conference. Ticket availability cannot be assured after noon, Wednesday, June 23.

LADIES PROGRAM

Tuesday, June 22. Mixer with husbands. See program. Sitter service available (call AS 4-0795 before 5:30 p.m.)

Wednesday, June 23. Bus trip with children to famed Cooperstown, home of Fenimore Cooper House, Farmer's Museum, Baseball Hall of Fame. Tours of each, or take in only what you want to see. Box lunch at Otsego Lake.

Wed. Eve. at the 15th St. Lounge, will be informal entertainment for those who can come: bridge, travel talk, visiting.

Thursday, June 24. Meet at 9:15 a.m. at the 15th St. Lounge to go by cars to the home of President and Mrs. Folsom for coffee hour, then at 10:30 by bus to Bennington, Vt., for visits to pottery, antiques, souvenirs, early New England Church, etc. Lunch at nearby restaurant.—During this morning children will have a program of sports (swimming, tennis, ball) with supervision at R.P.I. Lunch provided for children.

Friday, June 25. Coffee at R.S.E. House at 9:30. A short morning trip to Albany to tour the N.Y. State Capitol is planned.

NOTES: Reliable baby sitters at the usual fee will be provided for any afternoon or evening times. Call AS 2-3000 Ext. 376.

Tickets for Tours, Luncheons, and Trips can be reserved at the desk in the 15th St. Lounge anytime Tues. or Wed.

COMMITTEE MEETINGS

Location to be posted at registration desk each day.

Monday 9-12 AM

AACC Applications Committee
AACC Automation Committee

AACC Bibliography Committee
JACC Awards Committee
JACC Steering Committee
Eckman Award Committee
AACC Components Committee
AACC Long Range Planning Committee
AACC Theory Committee

Monday 2-5 PM

American Automatic Control Council meeting

Tuesday AM

This time is being held open for meetings of the technical societies, such as ASME-ACD, IEEE-G-AC, and so on.

Thursday 12-2 PM

AACC Education Committee
AACC Terminology Committee

CONFERENCE HOUSING

Check in at Warren Hall, Freshman Residence Halls Group.

All Room Assignments will be made at this central location.

Package plan includes room and meals. Extra nights and meals will be arranged at WARREN HALL when you arrive. Basic plan includes:

Room for nights of June 22, 23, 24

Meals start with Dinner June 22 through breakfast and lunch June 25.

No dinner June 24—Banquet night.

All meals will be cafeteria style in the Freshman Dining Hall.

Non-family housing will be in one of the Freshman Residence Halls where twin bedrooms are available with bath facilities on each floor—dormitory style. Room assignments will be made on a two-per-room basis unless registrant requests otherwise. Sharing preference should be indicated on Housing Request form.

Family groups will be housed in upper class residence units with private bath facilities.

Three day package rates per person:

Non-family housing	
Single	\$24.75
Double	17.25
Family housing	
Single	27.75
Double	18.75
Children	
(under 12)	9.00
(over 12)	15.75
(over 12—single room occupancy)	27.75

On-campus housing requests (center fold) should be returned to Prof. K. H. White.

Three day meals package (no room) \$9.75

A la carte meals—see schedule at registration desk.

NO REFUND FOR MEALS NOT TAKEN

OFF CAMPUS HOUSING

There are a number of good motels in the area as well as hotel accommodations in Albany and Troy. Arrangements of this type should be made through the

COPELAND TRAVEL AGENCY

2 Second Street
Hendrick Hudson Hotel
Troy, New York

NAME	LOCATION Near	RATES	
		Single	Double
Esquire	Airport	\$ 8.00	\$10.00-12.00
Thunderbird	Latham Circle	9.00	14.00-family unit
Latham	Latham	9.00	11.00-14.00
Howard Johnson	Northway	9.50	15.00
Belmar	Rt. 9 N. of Latham	8.00	10.00-14.00
Towne House	N. Blvd., Albany	8.00	14.00
Thruway	Wash. Ave., Albany	12.00	14.00-18.00
Tom Sawyer	Western Ave., Albany	7.00	12.50-16.50
Mt. Vernon	Rt. 9 E. of Albany	7.00	12.00-14.00

Hotels

Hendrick Hudson	Troy
Ten Eyck	Albany
DeWitt Clinton	Albany

Mileages

Airport to Latham	1 mile
Latham to RPI	5 miles
Airport to Albany	5 miles
Albany to RPI	8 miles

1965 JACC

Advance Program

New York World's Fair: If you missed it last year, make it this year; if you saw it last year, do it again; it's been refurbished and many new features have been added. Three hour drive from Troy.

Locally, **Saratoga Springs**, famous mineral spa and racing resort, is but a short drive from Troy, and offers the possibility of a very entertaining evening.

TECHNICAL PROGRAM

1965 JACC

There will be four simultaneous sessions during each time period indicated. Each paper is allotted one-half hour.

C.P.—Conference Paper

TUESDAY, JUNE 22, 2 - 5 p.m.

SESSION I SIMULATION LANGUAGES, TUTORIAL SESSION

SAGE 106

Chairman: Prof. W. A. Lynch
Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

1. "Analog Algol—A Program Language for Simulation"

Lavi, A., Westinghouse R & D Center, Pittsburgh, Pa.
Reilly, G., Same address

2. "SCADS—A Programming System for Simulation of Combined Analog-Digital Systems"

Strauss, J. C., Carnegie Institute of Technology, Pittsburgh, Pa.
Gilbert, W. L., Same address

3. "GASP—A General Activity Simulation Program"

Belkin, J., U.S. Steel Corp., Monroeville, Pa.
Kiviat, P. J., Rand Corp.
Colker, A., Management Control Systems

4. "Digital Simulation for Control System Design"

Linebarger, R., IBM, San Jose, Calif.
Brennan, R., Same address

5. "Models for Plant and Digital Control System Simulation"

Adams, G. E., University of Arizona

SESSION II INTEGRATED PLANT CONTROL, PANEL SESSION

SAGE 106

Chairman: Dr. Kan Chen
Westinghouse R & D Center, Churchill Borough, Pa.

SESSION III PROGRAMMING LANGUAGES FOR CONTROL COMPUTERS, PANEL SESSION

SAGE LECTURE HALL

Chairman: Prof. Gayle Adams
Arizona State University, Tempe, Ariz.
Vice Chairman: Dr. Robert N. Linebarger
IBM, San Jose, Calif.

SESSION IV OPTIMUM CONTROL, BOOK REVIEW

SAGE LECTURE HALL

Chairman: Dr. Rufus Oldenberger
Automatic Control Center, Purdue University, W. Lafayette, Ind.

SESSION V NONLINEAR CONTROLS

AMOS EATON 214

Chairman: Prof. John E. Gibson
Dept. of Electrical Engrg., Purdue University, W. Lafayette, Ind.
Vice Chairman: Prof. Robert H. Kohr
Dept. of Mech. Engrg., Purdue University, W. Lafayette, Ind.

1. "Special Graphical Construction Method for the Study of Nonlinear Systems"
Whitbeck, R. F., Flight Research Dept., Cornell Aero Lab., Inc., Buffalo, N. Y. IEEE
2. "A Method for the Exact Determination of Periodic Motions in Relay Controls Systems"
Mufti, H., Div. of Mech. Engrg., National Research Council, Ottawa, Ontario, Canada IEEE
3. "Sensitivity Analysis of Self-Excited Nonlinear Oscillations"
Siljak, Dr. D.D., Dept. of Electrical Engrg., University of Santa Clara, Santa Clara, Calif.
Stojic, Dr. M. R., Same address IEEE
4. "Transient Responses from the Liapunov Stability Equation"
Vogt, Prof. W. G., Univ. of Pittsburgh, Pittsburgh, Pa. ASME—C.P.
5. "Bang-Bang Aspects of Manual Control in High Order Systems"
Young Prof. L. R., MIT, Dept. of Aeronautics & Astronautics, Cambridge, Mass.
Meiry, Prof. J. L., Same address IEEE

SESSION VI DECISION AND ESTIMATION

SAGE 106

Chairman: Dr. R. Kalaba, The Rand Corp., Santa Monica, California
Vice Chairman: Lt. Henry Cox, David Taylor Model Basin, Washington, D. C.

1. "Differential Games and Optimal Pursuit-Evaluation Strategies"
Ho, Prof. Y. C., Harvard University, Div. of Engrg. & Applied Physics, Cambridge, Massachusetts
Bryson, Prof. A. E., Same address
Baron, S., Same address IEEE
2. "A Sample-Average Filter for Linear Control Systems"
Park, G. L., Michigan State Univ., Dept. of EE, E. Lansing, Mich. IEEE
3. "Estimation of Nonlinear System States and Parameters by Regression Methods"
Giese, C., E.E. Dept., Univ. of S. Calif., University Park, Los Angeles, Calif.
McGhee, R. B., Same address IEEE
4. "Sequential Estimation of States and Parameters in Noisy Non-Linear Dynamical Systems"
Sridhar, Prof. R., School of Elec. Engrg., Purdue Univ., W. Lafayette, Ind.
Detchmندی, D. M., Same address ASME
5. "Solution of a Linear Mean Square Estimation Problem When Process Statistics are Undefined"
Johansen, D. E., Applied Research Lab., Waltham, Mass. AIAA

SESSION VII OPTIMAL CONTROLS I

SAGE LECTURE HALL

Chairman: Prof. Robert Clark, Dept. of Electrical Engrg., Univ. of Washington, Seattle, Wash.

Vice Chairman: Dr. James Meditch, Aerospace Corp., Los Angeles, Calif.

1. "The Evolution of Control System Standards"
Mason, Dr. H. L., U.S. Dept. of Commerce, National Bureau of Standards, Washington, D.C. ASME—C.P.
2. "Feasible Optimization Methods for Interconnected Systems"
Brosilow, C. B., Systems Res. Center, Case Inst. of Tech., Cleveland, Ohio
Lasdon, L. S., Same address
Pearson, J. D., Same address AICHE
3. "A Multi-Level Technique for Optimization"
Lasdon, Prof. L., Case Institute of Technology, Cleveland, Ohio
Schoeffler, J. D., Same address IEEE
4. "A Multilevel Structure for a Class of Linear Dynamic Optimization Problems"
Pearson, J. D., Case Institute of Technology, Cleveland, Ohio
Takahara, Y., Same address
Mesarovic, M. D., Same address IEEE
5. "Multilevel Approach Applied to Control System Design"
Lefkowitz, Prof. I., Case Inst. of Tech., Cleveland Ohio ASME

SESSION VIII THE STATE OF THE ART
IN APPLICATIONS, 1 (INV.)

TROY, 101

Chairman: Dr. T. J. Williams, Monsanto Chemical Co., 800 N. Lindbergh Rd., St. Louis, Mo.

1. "State of the Automatic Control Art in the Electric Power Industry of the United States"
Cohn, Nathan, Leeds & Northrup Co., Philadelphia, Pa.
2. "Automatic Control in the Metallurgical Industry"
Miller, Wm. E., General Electric Co., Schenectady, N. Y.
3. "The Chemical Process Industries" (No Paper)
Silva, R. S.
4. "Aerospace Industries" (No Paper)
Savo, Dr. T. A., Hughes Aircraft Co.

SESSION IX CONTROL COMPONENTS

AMOS EATON 214

Chairman: Prof. J. L. Shearer, Dept. of Mech. Engrg., The Penn. State Univ., University Park, Pa.

Vice Chairman: D. Pidhayny, Aerospace Corp., Los Angeles, Calif.

1. "A Rate Gyroscope Based on Interaction of Sonic Waves"
Newton, G. C., Jr., Electronic Systems Lab., Dept. of EE, MIT, Cambridge, Mass. IEEE

2. "Analysis of a Pulse-Width-Modulated Hydraulic Servo"

Nikiforuk, Dr. P. N., Mech. Engrg. Dept., Univ. of Saskatchewan, Saskatoon, Sask. Canada

Ukrainetz, P. R.

Wristen W.

ASME—C.P.

3. "Small Displacement, Self-Balancing Differential Manometer"

Bell, W. H., Westinghouse Electric Corp., W. Mifflin, Pa. ASME—C.P.

4. "Proposed Test Standards for NOR and NAND Fluid Digital Amplifiers with some Preliminary Experimental Results"

Goldschmied, F. R., Sperry Utah Co., Div. Sperry Rand, Salt Lake City, Utah ASME—C.P.

5. "Development of a Pure Fluid Power Amplifier"

Orner, P. A., Giannini Controls Corp., Malvern, Pa.

Taft, Prof. C. K., Case Inst. of Tech., Cleveland, Ohio

ASME—C.P.

SESSION X MODELING

SAGE 106

Chairman: Prof. I. Lefkowitz, Case Institute of Technology, Cleveland, Ohio

Vice Chairman: Prof. C. W. Merriam, III, Cornell University, Ithaca, N. Y.

1. "Functional Representation of Nonlinear Systems, Interpolation and Lagrange Expansion for Functionals"

Gorman, Prof. D., Washington University of St. Louis, St. Louis, Mo.

Zaborsky, Prof. J., Same address

ASME

2. "The Effect of Coordinate Transformations on a Class of Control System Models"

Culver, W. J., Surface Div., Westinghouse Electric Corp., Baltimore, Md. IEEE

3. "Control Model Simplification Using a Two Level Decomposition Technique"

Durbeck, R. C., IBM, San Jose, Calif.

Lasdon, L. S., Systems Research Center, Case Inst. of Technology, Cleveland, Ohio AICHE

4. "A Unified Approach to the Synthesis of Orthonormal Exponential Functions Useful in Systems Analysis"

Mendel, J. M., Douglas Aircraft Corp., Santa Monica, Calif.

IEEE

5. "Performance of Process Models"

Gupta, S. C., Research & Development Center, Leeds & Northrup Co., N. Wales, Pa. ISA

SESSION XI OPTIMAL CONTROLS 2

SAGE LECTURE HALL

Chairman: Dr. Michael Athans, M. I. of T., Lexington, Mass.

Vice Chairman: Prof. Eugene Harrison, Dept. of Mech. Engrg., Ga. Inst. of Tech., Atlanta, Ga.

1. "On Synthesis of Optimal Bang-Bang Feedback Control Systems With Quadratic Performance Index"

Bass, R. W., Hughes Aircraft Co., Culver City, Calif.

Webber, R. F., Same address

IEEE

2. "Closed-Loop, Approximately Time-Optimal Control of Linear Systems"

Melsa, Dr. J. L., University of Arizona, Dept. of EE., Tucson, Ariz.

Schultz, D.G., Dr., Same address

IEEE

3. "The Frequency Domain Solution of Regulator Problems"

Willis, Prof. B. H., MIT, Dept. of EE, Cambridge, Mass.

Brockett, Prof. R. W., Same address

IEEE

4. "On a Class of Constrained Control, Linear Regulator Problems"

Tchamram, A., Syracuse University, EE Dept., Syracuse, N. Y. ASME

5. "A Technique of Quasi-Optimum Control"

Friedland, Dr. B., General Precision Aerospace, Little Falls, N. J. ASME

**SESSION XII STATE OF THE ART
IN APPLICATIONS II (INV.)**

TROY 101

Chairman: Dr. T. J. Williams, Monsanto Chemical Co., St. Louis, Mo.

1. "Developments in Automatic Controls for Machine Tools"

Taft, C. K., Case Institute of Technology, Cleveland, Ohio

Mazoh, Marvin, The Warner & Swasey Co., Cleveland, Ohio

2. "Biomedical Control Developments"

Coulter, Dr. N. A., Dept. of Physiology, Ohio State Univ., Columbus, Ohio

Updike, Dr. O. L., Div. of Biomedical Engrg., Univ. of Virginia, Charlottesville, Va.

3. "Functional Description and Development of an Automatic Train Control System."

Howell, J. K., Westinghouse Electric Corp., Transportation Systems Dept., Pittsburgh, Pa.

4. "Developments in Automatic Warehousing and Inventory Control"

Dallimonti, Renzo, Honeywell Inc., Philadelphia, Pa.

PLENARY SESSION

WEDNESDAY, JUNE 23 8 - 9:15 p.m.

WEST HALL AUDITORIUM

Welcome

Sidney Lees, General Chairman

Greeting from RPI

C. O. Dohrenwend, Provost

Greetings from School of Engineering RPI

Arthur A. Burr, Dean

Report by the President of the
American Automatic Control Council

Presentation of Prize Paper Awards

Presentation of the Donald P. Eckman Award

Implications of Automatic Control

Address by Leonard Woodcock

Vice President of United Automobile Workers

Address by J. Herbert Hollomon

Assistant Secretary of Commerce for Science and Technology

SESSION XIII DESIGN

AMOS EATON 214

Chairman: Prof. D. G. Luenberger, Stanford Electronic Labs., Stanford, Calif.

Vice Chairman: Prof. James Costanza, Dept. of Mech. Engrg., Univ. of Calif., Berkeley, Calif.

1. "An Approach to Interacting Control System Synthesis"

Birta, Prof. Luis, Case Institute of Technology, Cleveland, Ohio
Mesarovic, M.D., Same address IEEE

2. "A Method of Determining Minimal Order Linear Controllers"

Jensen, Dr. M. E., Stanford Linear Accelerator Center, Stanford, Calif. IEEE

3. "A Paper and Pencil Control System Design Technique"

Gustafson, Dr. R. D., School of Mech Engrg., Purdue University, W. Lafayette, Ind. ASME

4. "High Order System Design Via State Space Considerations"

Bass, R. W., Hughes Aircraft Co., Aerospace Group, Culver City, Calif.
Gura, I., Same address IEEE

5. "The Design of Nonlinear Multivariable Control Systems from State Dependent Linear Models"

Fertik, H. A., Case Institute of Technology, Cleveland, Ohio
Schoeffler, J. D., Same Address ASME

SESSION XIV ESTIMATION

SAGE 106

Chairman: Prof. H. Phillip Whitaker Instrumentation Labs., MIT, Cambridge, Mass.

Vice Chairman: Dr. J. E. Matheson, Westinghouse R & D Center, Pittsburgh, Pa.

1. "A Self-Adaptive System with Auxiliary Adjustment Prediction"

Perlis, Prof. H. J., Rutgers—The State University, Dept. of EE, New Brunswick, N. J. New IEEE

2. "A Learning Control System Using Stochastic Approximation for Hill-Climbing"

Hill, J. D., Bellcomm Inc., Washington, D. C.
Fu, K. S., Same address IEEE

3. "Control of a Linear System with a Markov Property"

Sworder, Prof. D. D., Univ. of S. California, Los Angeles, Calif. IEEE

4. "The Scientific Inferential Relationships Between Statistical Estimation, Decision Theory and Modern Filter Theory"

Smith, Dr. G. L., NASA—Ames Res. Center, Moffett Field, Calif. AIAA

5. "Uncertainty and Imprecision"

Lees, Prof. S., Thayer School of Engrg., Dartmouth College, Hanover, N.H. ASME

SESSION XV OPTIMAL CONTROLS III

SAGE LECTURE HALL

Chairman: Dr. D. J. Wilde, Chemical Engrg. Dept., Stanford University, Stanford, Calif.

Vice Chairman: Dr. Theodore Edlebaum, Research Dept. United Aircraft Corp., East Hartford, Conn.

1. "Function Space Methods for the Optimum Control of a Class of Distributed Parameter Control Systems"

Axelband, E. I., Hughes Aircraft Co., Space Systems Div., El Segundo, Calif. IEEE

2. "Minimum Mean Square Error Design of Distributed-Parameter Control Systems"

Pierre, Dr. D. A., Montana State College, Bozeman, Mont. ISA

3. "Optimal Control of Systems with Distributed Parameters"

Goodson, Prof. R. E., Mech. Engrg. Dept., Purdue University, W. Lafayette, Ind.
Khatiri, H. C., Same address ASME

4. "Minimum Energy Control of a Linear Plant with Magnitude Constraint on the Control Input Signal"

Stubberud, Dr. A. R., University of California, Los Angeles, Calif.
Swiger, J. M., Same address IEEE

5. "The Application of Quality Control Data in Feedback Systems"

Taft, Prof. C. K., Case Institute of Technology, Cleveland, Ohio
Loeb, Dr. J., Corning Glass Works, Corning, N. Y. ISA

**SESSION XVI THE STATE OF THE ART
IN COMPONENTS, 1 (INV.)
NEW SOLID STATE POWER COMPONENTS**

TROY 101

Chairman: H. F. Storm, General Electric Co.

Vice Chairman: A. R. Catheron, The Foxboro Co., Foxboro, Mass.

1. "Integrated Circuits for Automatic Control"

Thurston, M. O., Ohio State University, Columbus, Ohio

2. "Present-Day Solid-State Power Switches"

Harnden, J. D., Jr., General Electric Co., Advanced Technology Laboratories, Schenectady, N. Y.

3. "Application Features of the Gate-Controlled Switch Compared to Transistors Operating in the Switching Mode"

Motto, J. W., Jr., Westinghouse Electric Corp., Semi-Conductor Div., Youngwood, Pa.

4. "Some Industrial Power Applications of Silicon Thyristors"

Walker, A. H. B., Westinghouse Electric Corp., Research Laboratories, Pittsburgh 35, Pa.
Schlabach, L. A., Same Company

5. "Gate Controlled A-C Switches"

Storm, H. F., General Electric Co.
Watrous, D. L., Same Company

THURSDAY, JUNE 24, 2 - 5 p.m.

SESSION XVII IDENTIFICATION

AMOS EATON 214

Chairman: Prof. O. L. Updike, Dept. of Chem, Engrg., Uni. of Va.,
Charlottesville, Va.

Vice Chairman: Dr. Joel Hougen, Monsanto Chemical Co., St. Louis, Mo.

1. "State Identification in Finite State Systems Having Input-Output Noise"

Gagliardi, R. M., Univ. of S. Calif, Los Angeles, Calif. IEEE

2. "Statistical Structural and Regression Models in Linear Process Identification"

Kerr, R. B., Lockheed Missiles & Space Co., Huntsville, Ala.

3. "Accurate Determination of Complex Root Transfer Functions from Frequency Response Data"

Chen, C. F., Christian Brothers College, Dept. of EE, Memphis, Tenn.
Philip, B. L., Same address IEEE

4. "The Identification of Linear Systems"

Fisher, E. E., Honeywell, Inc., St. Paul, Minn. ASME—C.P.

5. "Approximate Identity in Linear Continuous and Sampled-Data Servomechanisms"

Rault, A. J., Kansas State University, Dept. of EE, Manhattan, Kan. IEEE

SESSION XVIII SPACE AND CONTROL APPLICATIONS

SAGE 106

Chairman: Dr. George Kovatch, NASA Electronics Research Center,
Cambridge, Mass.

Vice Chairman: David Griep, Aerospace Corp., El Segundo, Calif.

1. "Application of Optimization Theory to the Design of a Missile Control"

Duersch, R. R., General Electric Co., Schenectady, N. Y. IEEE

2. "An Optimal Discrete Control Strategy for Terminal Guidance"

Tung, F., Lockheed Missiles & Space Co., Palo Alto, Calif. IEEE

3. "A Missile Adaptive Roll Autopilot with a Small-Amplitude Limit Cycle"

Stallard, D. V., Raytheon Co., Missile Systems Div., Bedford, Mass. IEEE

4. "Stabilization and Control of a Cable-Connected Spinning Space Station"

Hutchinson, I. N., Sperry Gyroscope Co., Div. of Sperry Rand Corp.,
Great Neck, N. Y.

Morrison, R. F., Same address

Keller, J. L., Same address IEEE

5. "Closed Loop Stepping Motor Application"

Fredriksen, T. R., IBM Corp., Products Div., San Jose, Calif. IEEE

SESSION XIX OPTIMAL CONTROLS 4

SAGE LECTURE HALL

Chairman: Dr. H. J. Kelly, Analytical Mechanics Association, Uniondale,
N. Y.

Vice Chairman: Dr. R. L. Zahrodnik, Westinghouse Research Labs.,
Churchill Borough, Pa.

1. "Optimum Discrete Systems with Amplitude and Energy Constrained Control Function"

Kim, Prof. M., School of E. E., Cornell University, Ithaca, N.Y. ISA

1965 JOINT AUTOMATIC CONTROL CONFERENCE

CONFERENCE FEE SCHEDULE

Ret. to: Rensselaer Polytechnic Institute
Troy, New York. Attn: C. N. Shen

Conference fee . . . at \$24 or \$28 \$
Preprint volume . . . extra copies at \$25
Banquet . . . tickets at \$6.75 ea.
Total (checks payable to 1965 JACC)

Fill in mailing label(s)
for preprint volume(s)

Please HELP Us Plan

For Your Convenience, Complete:

1. Will bring wife to conference? YES ☐ NO ☐
2. Wife will attend some tours? YES ☐ NO ☐
3. (Wife and/or I) will attend mixer? YES ☐ NO ☐

All tickets and conference badge will be waiting for you at Preregistration
table in the Freshman Dining Hall. FILL IN BOTH SIDES OF FORM.

FROM: JACC, Rensselaer Polytechnic Institute
Troy, New York

TO:

FROM: JACC, Rensselaer Polytechnic Institute
Troy, New York

TO:

PREREGISTRATION FORM

Return to: **Rensselaer Polytechnic Institute**
Troy, New York. Attn: C. N. Shen

Name _____
 Company _____
 Department _____
 Address _____
 City _____ State _____

Membership or Status: Check appropriate blocks

☐ AIAA Fee \$24	☐ AIChE Fee \$24	☐ ASME Fee \$24	☐ IEEE Fee \$24	☐ ISA Fee \$24	☐ Nonmem. Fee \$28	☐ Student No Charge
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-- Fill in both sides of form --

If you wish preprint volume sent to you, fill in mailing label on reverse side. Volume will not be sent after May 28, 1965.

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2. "A Study of Minimum Norm Control for Sampled-Data Systems"
Cadzow, J. A., State University of New York, Buffalo, N. Y. IEEE
3. "A Successive Sweep Method for Solving Optimal Programming Problems"
McReynolds, S. R., Pierce Hall, Harvard University, Cambridge, Mass. AIAA
Bryson, Prof. A. E., Same address
4. Optimum Nonlinear Control of a System with Two Inputs and One Output"
Oldenburger, Prof. R., Purdue University, Automatic Control Center, W. Lafayette, Ind.
Okamura, K., Same address IEEE

SESSION XX STATE OF THE ART
IN COMPONENTS II (INV.),
FLUID CONTROL COMPONENTS

TROY 101

Chairman: R. W. Henke, Fluid Power Institute, Milwaukee School of Engineering, Milwaukee, Wisc.

Vice Chairman: Carl Janow, NASA, Washington, D. C.

1. "Component Parameter and Characteristics Specification"
Weed, Prof. H. R., Ohio State University, Columbus, Ohio
2. "A Candid Look at Fluid Control Systems—1965"
Shearer, Prof. J. L., The Pa. State Univ., University Park, Pa.
3. "The Future of Fluid Amplifiers in Commercial Controls"
Bjornsen, B. G., Johnson Service Co., Milwaukee, Wis.
4. "The Univac Fluid Computer"
Gluskin, R. S., Univac Div. of Sperry Rand, Blue Bell, Pa.
5. "New Fluid Amplifier Techniques for Speed Control"
Boothe, W. A., General Electric Co., Advanced Technology Laboratories, Schenectady, N. Y.

FRIDAY, JUNE 25, 9 a.m. - 12 noon

SESSION XXI STABILITY 1

SAGE LECTURE HALL

Chairman: Prof. Rufus Oldenburger, Purdue Uni., W. Lafayette, Ind.
Vice Chairman: Dr. N. H. Choksy, Applied Phys. Lab., Johns Hopkins Univ., Silver Spring, Md.

1. "Stability-Boundary Approximations for Relay-Control Systems Via Steepest-Ascent Construction of Liapunov Functions"
Weissenberger, S., Lockheed Missiles & Space Co., Sunnyvale, Calif. ASME
2. "On the Liapunov Functions for a Class of Nonlinear Nonautonomous System"
Puri, Dr. N. N., General Electric Co., Philadelphia, Pa. ASME
3. "Extension of the Integral Method of Liapunov Function Generation to Coupled Nonlinear Autonomous Systems"
Walker, Prof. J. A., The Tech. Inst., Northwestern University, Evanston, Ill. ASME—C.P.

4. "New Theorems and Examples in the Liapunov Theory of Stochastic Stability"

Kushner, Dr. H. J., Center for Dynamical Studies, Brown University, Providence, R.I. ASME—C.P.

5. "On the Application of Hydrodynamics to the Study of the Stability of Singular Points of Differential Equations: Autonomous Systems"

Boyanovitch, D., Grumman Aircraft Engrg. Corp., Bethpage, N.Y. ASME

SESSION XXII POWER APPLICATIONS

AMOS EATON 214

Chairman: Prof. A. Lavi, Dept. of Electrical Engrg., Carnegie Institute of Technology, Pittsburgh, Pa.

Vice Chairman: Dr. J. R. Voss, Woodward Governor Co., Rockford Ill.

1. "Fluid Centerline-Velocity Effect on Fluid-Temperature Transients in a Heat Exchanger"

Thal-Larsen, Prof. H., Mech. Engrg., Univ. of Calif., Berkeley, Calif. ASME

2. "Control Aspects of a Large Dual-Purpose Nuclear Reactor Plant"

Leiby, D. W., N-Reactor Dept., General Electric Co., Richland, Wash. ASME—C.P.

3. "Application of the Maximum Principle for Bounded State Space to the Hydro-Steam Dispatch Problems"

Dahlin, E. B., General Products Div., Dev. Lab., San Jose, Calif. IEEE
Shen, D. W. C., Same address

4. "Sensitivity Methods for Economic Dispatch of Hydroelectric Plants"

Ringlee, Dr. R. J., General Electric Co., Schenectady, N.Y. IEEE

5. "Steam Generator Water Level Control"

Nahavandi, A. N., Westinghouse Electric Corp., Atomic Power Div., Pittsburgh, Pa. ASME—C.P.
Batenburg, Abram, Same address

SESSION XXIII SAMPLED DATA SYSTEM

SAGE 106

Chairman: Prof. La. A. Zadeh, Dept. of EE, Univ. of California, Berkeley, Calif.

Vice Chairman: Dr. J. E. Bertram, IBM Research, San Jose, Calif.

1. "Upper Bound on Dynamic Quantization Error in Digital Control Systems Via the Direct Method of Liapunov"

Johnson, G. W., Space Systems Group, IBM-Federal Systems Div., Cambridge, Mass. IEEE

2. "Error Bounds for Jittered Sampling"

Liu, Prof. Bede, Princeton Univ., Sch of Eng'g & App'd Sc., Princeton, N.J. IEEE
Stanley, T. P., Same address

3. "A Consideration of the Discrete Volterra Series"

Alper, Dr. Paul, Div. of Auto. Control, Tech. Univ. of Norway, Trondheim, Norway IEEE

4. "An Application of Sampled Data Adaptive Optimization"

Frey, A. L., Dept. of Chemical Engrg., Univ. of Wisconsin, Madison, Wis. AICHE
Deem, W. B., Same address
Altpeter, R. J. Same address

5. "Time Domain Matrix Analysis of Nonlinear Quantized Hybrid Systems"

King, R. E., EE Dept., Columbia University, New York, N.Y. ASME
Williamson, D., EE Dept., Queen's Univ., Belfast, N. Ireland

SESSION XXIV STATE OF THE ART IN COMPONENTS, III (INV.) NUMERICAL CONTROL—THE COMPONENT VIEWPOINT

TROY 101

Chairman: P. P. Fischer, General Electric Co., Philadelphia, Pa.

1. "Numerical Control—The Component Viewpoint"

Fischer, P. P., General Electric Co., Philadelphia, Pa.

2. "Software—A Vital Component in Numerical Control"

Richard A. Thomas, Specialty Control Dept., General Electric Co., Waynesboro, Va.

3. "Servo Components of Numerical Control"

Kelling, L.U.C., General Electric Industrial Controls Div., Waynesboro, Va.

4. "An Industrial Robot"

Dunne, M. J., Unimation, Inc.

5. "Application of Numerical Controls to a Manufacturing Dept."

Seymour, C. P., Hewlett-Packard, Inc., Palo Alto, Calif.

FRIDAY, JUNE 25, 2 - 5 p.m.

SESSION XXV STABILITY 2

SAGE LECTURE HALL

Chairman: Dr. P. Falb, Lincoln Labs., MIT, Cambridge, Mass.

Vice Chairman: Prof. Z. V. Rekasius
Northwestern University, Evanston, Ill.

1. "Frequency Domain Stability Criteria, Part I"

Brockett, Prof. R. W., MIT, Dept. of EE, Cambridge, Mass. IEEE
Willem, S. L., Same address

2. "Frequency Domain Stability Criteria, Part II"

Brockett, Prof. R. W., MIT, Dept. of EE, Cambridge, Mass. IEEE

3. "On Two Theories Concerning the Dangerousness of Stability Boundaries in Nonlinear Systems"

Amyet, J. R., University of Manitoba, Dept. of EE, Winnipeg, Can. IEEE
Johnson, Prof. R. A., Same address

4. "The Use of Lur's Forms to Establish a Sufficient Condition for Stability of a Class of Discrete Feedback Systems with Parallel Nonlinear Elements"

Murphy, G. J. Information-Processing & Control Systems Lab., Northwestern University, Evanston, Ill. ASME
Mu, S. H. Same address

5. "Extension of Popov's Theorems for Stability of Nonlinear Control Systems"

Ku, Y. H., The Moore Sch. of E. E., Univ. of Pa., Philadelphia, Pa. ISA
Chieh, H. T., Same address

SESSION XXVI SIMULATION AND DESIGN APPLICATIONS

AMOS EATON 214

Chairman: Dr. Robert Mathias,
Westinghouse Electric Corp., Pittsburgh, Pa.

Vice Chairman: Prof. J. M. Mozley, Johns Hopkins Hospital,
Baltimore, Md.

1. "Dynasor Input/Output Concepts"

Watson, J. M., Simulation Council, General Electric Co., Schenectady, N.Y. ASME—C.P.

2. "Dynasar Analysis Methods Developed for the Dynamic Systems Analyzer"

Lucke, V. H., Mech. & Engrg. Systems Unit, General Electric Co., Cincinnati, Ohio ASME—C.P.

3. "Dynasar Applications"

Durand, H. P., Simulation Council, General Electric Co., Cincinnati, Ohio ASME—C.P.

4. "Design of Minimum Inertia Servo Gear Trains"

Lance, Prof. G., The University of Iowa, Iowa City, Iowa
Liittschwager, Prof. J., Same address ASME—C.P.

5. "The Use of Magnetostriction to Achieve Fast Adjustment of Roll Separation in Multi-Stand Rolling Mills"

Granborg, Prof. B. S. M., University of Hawaii, Dept. of EE, Honolulu, Hawaii IEEE

SESSION XXVII TIME VARYING SYSTEMS

SAGE 106

Chairman: Prof. Henry Paynter, Dept. of Mech. Engrg., MIT, Cambridge, Mass.

Vice Chairman: Prof. E. S. McVey, Dept. of EE, Univ. of Virginia, Charlottesville, Va.

1. "Dynamic Analysis of Some Time Varying Distributed Systems"

Seaton, G. W., Dept. of Chemical Engrg., Lehigh University, Bethlehem, Pa.
Scheisser, W. F., Same address AICHE

2. "Drift Compensation of Linear Systems by Parameter Adjustments"

Rissanen, J., EAI, Princeton, N.J. ASME

3. "Design and Synthesis of Linear Time-Variant Automatic Control Systems"

D'Angelo, Prof. H., University of Denver, Denver, Colo.
Higgins, Prof. T. J., Dept. of EE, Univ. of Wisc., Madison, Wis. ISA

4. "Optimization of Time-Varying Systems"

McBride, Prof. L. E., Jr., Princeton Univ., Sch. of Eng'g & App'd Sc., Princeton, N.J.
Narendra, K. S., Harvard University, Cambridge, Mass. IEEE

5. "A Function Space Approach to the Identification of Linear Systems, Part I: Formulations for Time Invariant and Time Varying Systems; on the Uniqueness and Construction of Solutions"

Pearson, Dr. A. E., Div. of Engrg., Brown Univ., Providence, R.I. ASME

SESSION XXVIII RELIABILITY

TROY 101

Chairman: Dr. A. R. Park, Kearfott Div., General Precision, Inc., San Marcos, Calif.

Vice Chairman: Dr. Lou Padison, Sandia Corp., Albuquerque, N.M.

1. "Mathematical Concepts in Reliability"

Madison, R. L., Booz, Allen Applied Research, Inc., Bethesda, Md.

2. "Applied Reliability Analysis"

Weiss, D. W., Booz, Allen Applied Research, Inc., Bethesda, Md.
Butler, D. M., Same address

3. "The Moment Technique for Predicting the Drift Reliability of Control Systems"

Wertz, J. B., Battelle Mem. Inst., Columbus, Ohio
Mesloh, R. E., Same address
Easterday, J. L., Same address

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2. *Surface*: The nearest rail terminal is at Albany, eight miles south, served by the New York Central, also the Delaware and Hudson. Greyhound and Trailways provide inter-city bus service into their respective Albany terminals; Greyhound also provides limited service to downtown Troy—usually involving about an hour layover in Albany. Also there is local Albany to Troy bus service at regular intervals, which must be supplemented by a taxi ride to the RPI campus.

3. *Private cars*: The enclosed in-and-out map of Troy gives directions to the RPI campus. A detailed map of the campus, showing parking areas will be available at the registration desk.

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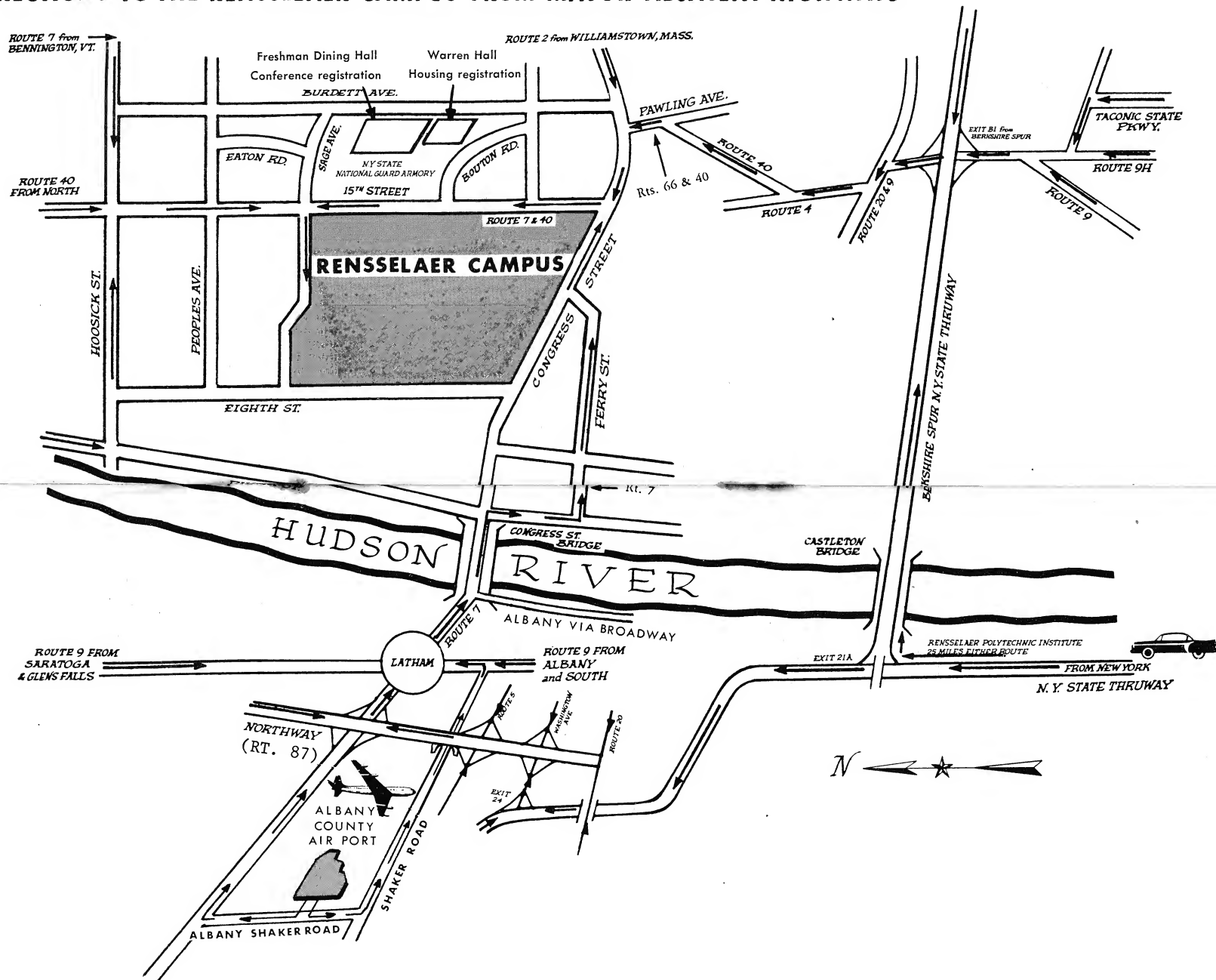
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